

**TITLE OF THE INVENTION**

**FINGERPRINT RECOGNIZING DISPLAY AND  
OPERATING METHOD THEREOF**

**CLAIM OF PRIORITY**

This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C §119 from an application entitled *Display System Possible Of Fingerprint Recognition And Operating Method Thereof* earlier filed in the Korean Industrial Property Office on 8 November 1999, and there duly assigned Serial No. 99-49230 by that Office.

**BACKGROUND OF THE INVENTION**

**Field of the invention**

The present invention relates to a display system, more particularly, to a fingerprint recognizing display system including fingerprint recognizing means in a panel of a display apparatus and an operating method thereof, wherein a fingerprint of an user is read and a program supported by a computer is allowed to be operated only if the read fingerprint is registered in a fingerprint data base of the computer.

**Description of the Prior Art**

As the environment related to the Internet and the personal computer (PC) rapidly changes,

1 there is an increasing problem that a hacker, *i.e.*, an unauthorized user, can gain access to files,  
2 personal or company information on the computer which in turn can be damaged, downloaded or  
3 deleted. Additionally all the information in a computer can disappear because of a virus.  
4 Accordingly, it becomes necessary to be able to increase the security of the computer or other hosts,  
5 such as a terminal unit, network or network-based system to prevent the above problems.

6 To resolve the above problems, a computer connected to a network includes features such  
7 as required password access in order to protect the information therein. However, sometimes a  
8 password is chosen as a word easily guessed or a common word easily searched by a search program  
9 using dictionary data base. Therefore, an unauthorized user can discover the password and gain  
10 access to the data on the computer.

11 To resolve the problem regarding password protection, a fingerprint recognizing module has  
12 been applied to a computer system, wherein a fingerprint data base is established after obtaining the  
13 fingerprint of authorized users. Thus, when one desires to gain access to the data on the computer  
14 system, or operate a program therein, their fingerprint is compared to the data in the fingerprint data  
15 base before they are permitted to use the computer.

16 For example, such systems were disclosed in U.S. Patent No. 5,838,306 to Clint O'Conner  
17 et al. and entitled *Mouse With Security Feature* and U.S. Patent No. 5,420,936 to Greg P. Fitzpatrick  
18 et al. and entitled *Method And Apparatus For Accessing Touch Screen Desktop Objects Via*  
19 *Fingerprint Recognition*.

20 The invention disclosed in U.S. Patent No. 5,420,936 provides touch-sensitive fields on a  
21 computer display for user selection. Upon selecting one of the fields with a fingertip, a fingerprint

1 therefrom is analyzed and compared to a list of authorized fingerprints. Once the fingerprint passes  
2 inspection, the user is granted access to the underlying program. It is difficult, however, to apply this  
3 invention to a general monitor since a touch screen is required.

4 The invention disclosed in U.S. patent No. 5,838,306 utilizes a computer mouse as an input  
5 peripheral device which includes a window area integrally constructed within the mouse and  
6 positioned at an area on the mouse upon which a user normally places a finger in operating the  
7 mouse. The mouse further includes an illuminating device and a light sensitive detection device for  
8 providing a user signature signal representative of the characteristics of the ridge and valley pattern  
9 of the fingerprint of a finger placed upon the window area. The signature signal is transmitted to a  
10 BIOS within the computer system in which the mouse is operating and compared with one or more  
11 stored patterns which have previously been authorized for access to the computer system. When the  
12 user's signature signal is compared with and matches one of the stored and approved signature  
13 signals, the system is enabled and the user is granted access. However, if a fingerprint recognizing  
14 module is included into a mouse, it is inconvenient to use the mouse because the weight and size of  
15 the mouse are increased.

16 Also, users often pick up the mouse to move it and in so doing they may drop the it. Thus,  
17 a fingerprint recognizing module or a fingerprint recognizing unit within the mouse may be damaged  
18 due to the shock caused by its being dropped, and a user's fingerprint may not be correctly  
19 recognized. In addition, some computer systems may not need a mouse, but in order to incorporate  
20 the fingerprint recognition disclosed in the 5,838,306 patent, one must buy the mouse having the  
21 features disclosed therein. Also, a fingerprint recognizing module is automatically changed at the

time of changing a mouse according to the prior art, and the user is charged an unreasonable cost.

## SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a fingerprint recognizing display system including fingerprint recognizing module into a panel of a display apparatus and an operating method thereof, wherein an user's fingerprint data is read, the read fingerprint data is transmitted to a computer main body by using a communication unit included in a fingerprint recognizing module of a display apparatus, and a program supported by the computer main body will be operated only if the fingerprint data transmitted from the display apparatus is included in the fingerprint data registered into the computer main body.

Another object of the present invention is to provide a fingerprint recognizing display system and an operating method thereof, wherein a panel of a display apparatus includes fingerprint recognizing module, the fingerprint recognizing module reads fingerprint data of the user, the read fingerprint data is transmitted to a computer main body by using its own communication protocol of the display apparatus, and a program supported from the computer can be operated only if the transmitted fingerprint data is registered in the computer main body.

To achieve the above objects, an apparatus according to the present invention comprises a display apparatus including a fingerprint recognizing module, recognizing a fingerprint of an user through the fingerprint recognizing module and outputting the recognized fingerprint data by using communication unit included in the fingerprint recognizing module, and a computer main body including a fingerprint data base having more than one fingerprint data and a fingerprint verifying

1 unit, and operating a program after deciding whether fingerprint data input from the display  
2 apparatus is an approved fingerprint through the fingerprint data base and the fingerprint verifying  
3 unit.

4 Additionally, in a display system wherein a microprocessor of a display apparatus according  
5 to the present invention receives a video signal and a control signal from a video card of a computer  
6 main body in accordance with a communication protocol and outputs a video signal on a screen, the  
7 display apparatus includes a fingerprint recognizing module and recognizes the user's fingerprint  
8 through the fingerprint recognizing module, and the recognized fingerprint data is output to the  
9 microprocess through a communication protocol and to the computer main body in accordance with  
10 a communication protocol equipped between the display apparatus and the computer main body, and  
11 the computer main body comprises a fingerprint data base including more than one fingerprint and  
12 a fingerprint verifying unit, receives the fingerprint data input from the display apparatus through  
13 the communication protocol input to the video card and operates a program after deciding whether  
14 the input fingerprint is an approved fingerprint by the fingerprint data base and the fingerprint  
15 verifying unit, and then a program is operated.

16 Also, the display apparatus according to the present invention comprise further a front cover  
17 and fingerprint recognizing module placed in a side or front panel of the front cover.

18 Further, the display apparatus according to the present invention is characterized by  
19 integrating the fingerprint recognizing module to a power switch.

20 Further yet, a system operating method according to the present invention is characterized  
21 by including fingerprint data base in a computer main body and by driving the system only if

1 fingerprint data transmitted to communication unit of the computer main body through the  
2 communication unit of a fingerprint recognizing module included in a display apparatus is registered  
3 in the fingerprint data base.

4 Yet further, a system operating method according to the present invention is characterized  
5 by including fingerprint data base in the computer main body and by driving the system only if  
6 fingerprint data transmitted to communication unit of the computer main body through its own  
7 communication protocol of a display apparatus is registered in the fingerprint data base.

#### 8 **BRIEF DESCRIPTION OF THE DRAWINGS**

9 A more complete appreciation of the present invention, and many of the attendant  
10 advantages thereof, will become readily apparent as the same becomes better understood by  
11 reference to the following detailed description when considered in conjunction with the  
12 accompanying drawings in which like reference symbols indicate the same or similar components,  
13 wherein:

14 Fig. 1 is a perspective view illustrating a general monitor.

15 Fig. 2 is a view illustrating an embodiment according to the present invention.

16 Fig. 3 is a view illustrating another embodiment according to the present invention.

17 Fig. 4 is a perspective view illustrating a cathode ray tube (CRT) display unit to which a  
18 fingerprint recognizing part shown in Fig. 2 or Fig. 3 is applied.

19 Fig. 5 is a perspective view illustrating a display apparatus for a liquid crystal display (LCD)  
20 to which a fingerprint recognizing part shown in Fig. 2 or Fig. 3 is applied.

1 Fig. 6 is a flowchart illustrating steps according to the present invention applied to an  
2 operating system's (O/S) kernel mode.

3 Fig. 7 is a flowchart illustrating a management and a registration of fingerprint data applied  
4 to the present invention.

5 Fig. 8 is a flowchart illustrating steps according to the present invention applied to a screen  
6 protecting mode.

7 Fig. 9 is a flowchart illustrating a routine encoding/decoding a file by using the present  
8 invention.

### 9 **DETAILED DESCRIPTION OF THE PRESENT INVENTION**

10 Hereinafter, a preferred embodiment of the present invention will be described in details with  
11 reference to the accompanying drawings. The term "display system" used in the present invention  
12 means a total system including a display apparatus 100 and a computer main body 200.

13 Fig. 1 is a perspective view illustrating a general monitor M. Fig. 2 is a view illustrating an  
14 embodiment of the present invention. As shown in Fig. 2, a display system comprises a display  
15 apparatus 100 including a fingerprint recognizing module 110, recognizing an user's fingerprint  
16 through the fingerprint recognizing module 110 and outputting the recognized fingerprint data  
17 through a first communication unit 113 included in fingerprint recognizing module 110, and a  
18 computer main body 200 including a fingerprint data base 210 and fingerprint verifying unit 220,  
19 receiving fingerprint data output from display apparatus 100 through a second communication unit  
20 240, deciding whether the input fingerprint data is an approved fingerprint data through fingerprint

1 data base 210 and fingerprint verifying unit 220, and driving a program only if the input fingerprint  
2 data is approved.

3 Fingerprint recognizing module 110 in display apparatus 100 comprises a fingerprint image  
4 recognizing unit 111 providing a fingerprint sign of an user representing the user's fingerprint, a  
5 converter 112 converting analog fingerprint data input from the fingerprint image recognizing unit  
6 111 to digital fingerprint data, and communication unit 113 outputting the digital fingerprint data  
7 to communication unit 240 in computer main body 200.

8 Fingerprint image recognizing unit 111 can be embodied by an optical sensing method using  
9 a prism or hologram sensing method and a non-optical sensing method using a sensor array,  
10 ultrasonic or magnetic sensing method.

11 The display apparatus 100 also comprises a memory 130, an image signal processing unit 140  
12 and a microprocessor 120.

13 Fingerprint verifying unit 220 in computer main body 200 comprises a distinctive feature  
14 detecting unit 221 detecting a distinctive feature of the fingerprint data input by communication unit  
15 240, a fingerprint matching/recording unit 222 decoding the encoded fingerprint data stored in the  
16 fingerprint data base 210 through a decoding unit 224, comparing the decoded fingerprint data with  
17 the fingerprint data input from distinctive feature detecting unit 221 and storing new fingerprint data  
18 into fingerprint data base 210 after encoding the same through an encoding unit 225 if any new  
19 fingerprint data is input through communication unit 240, and a recognizing unit 223 outputting a  
20 "pass" signal or a "fail" signal by using the result input from fingerprint matching/recording unit 222.

21 Computer main body 200 further comprises a video card 230, a central processing unit (CPU)



1 250, a memory 260, and a ROM 270.

2 Fig. 3 is a view showing another embodiment according to the present invention. As shown  
3 in Fig. 3, a display system comprises a display apparatus 100a which includes a fingerprint  
4 recognizing module 110a, recognizing the user's fingerprint through the fingerprint recognizing  
5 module 110a, receiving the recognized fingerprint data into microprocessor 120 and outputting the  
6 same to a computer main body 200 through its own communication protocol, wherein the computer  
7 main body 200, including fingerprint data base 210 and fingerprint verifying unit 220, receives the  
8 fingerprint data input from display apparatus 100 through a communication protocol input to video  
9 card 230 and drives a program only if the received fingerprint is approved by fingerprint data base  
10 210 and fingerprint verifying unit 220.

11 Fingerprint recognizing module 110a comprises fingerprint image recognizing unit 111  
12 providing a fingerprint sign of the user representing the user's fingerprint and converter 112  
13 converting analog fingerprint data input from the fingerprint image recognizing unit 111 to digital  
14 fingerprint data and outputting the latter to microprocessor 120 included in display apparatus 100.

15 The fingerprint image recognizing unit 111 shown in Figs. 2 and 3 can be applied to a CRT  
16 display apparatus or a display apparatus for a LCD as shown in Figs. 4 and 5. In other words, the  
17 fingerprint image recognizing unit 111 reading the user's fingerprint is installed in a front cover 300  
18 of a LCD or CRT display apparatus and a front or side panel of the front cover 300.

19 Additionally, the fingerprint image recognizing unit 111 is formed integrally at a power  
20 switch 111a and a power on/off signal of a display unit is output if the power switch 111a is deeply  
21 pressed. Generally, the power switch 111a is used as the fingerprint image recognizing unit 111 and

1 reads the user's fingerprint if the user touches the power switch.

2 The other compositions of the display apparatus 100 and the computer main body 200 are  
3 not different from the above embodiment and will not be described in details.

4 An operation of the display system recognizing a fingerprint according to the present  
5 invention will be described with reference to the flowcharts shown in Figs. 6 - 9.

6 Fig. 6 is a flowchart illustrating steps according to the present invention applied to an O/S  
7 kernel mode. When the user turns on the power of a display apparatus 100 and a computer main  
8 body 200, the computer main body 200 decides whether a fingerprint data base 210 is established  
9 (S500).

10 If the fingerprint data base 210 is not established, the computer main body 200 recognizes  
11 a display system as being activated, controls the total system to maintain the display system in an  
12 active state (S505). Thereafter, a fingerprint registration step (S510) is enabled and fingerprint data  
13 is registered (stored) in fingerprint data base 210.

14 When it is determined in step S500 that fingerprint data base 210 is established in the  
15 computer main body 200, the computer main body 200 decides whether a monitor, *i.e.*, CRT or LCD,  
16 connected to the computer main body 200 is a fingerprint recognizing monitor (S515).

17 When it is determined in step S515 that the monitor is not a fingerprint recognizing monitor  
18 100, the computer main body 200 recognizes (S520) the monitor as having an abnormal status and  
19 the total system is not operated (S520).

20 When it is determined in step S515 that the monitor is a fingerprint recognizing monitor, the  
21 fingerprint recognizing unit 111 reads a fingerprint of a user and decides whether the fingerprint

1 image is normally received (S530). When it is determined that a fingerprint image is normally  
2 received, the normally received fingerprint image is converted to digital fingerprint data and  
3 transmitted to the computer main body 200 (S535). At this time, when the apparatus shown in Fig.  
4 2 is used, the fingerprint data is transmitted to communication unit 240 in the computer main body  
5 200 through communication unit 113 included in a fingerprint recognizing module 110. On the other  
6 hand, when the embodiment shown in Fig. 3 is used, the fingerprint data is output to microprocessor  
7 120 in display unit 100 by using I<sup>2</sup>C ((IIC) Inter-IC bus), DDC (Display Data Channel) or USB  
8 (Universal Serial Bus) communication protocol. Then, microprocessor 120 outputs the fingerprint  
9 data to video card 230 by using its own communication protocol and communication unit 240 in the  
10 computer main body 200 receives the fingerprint data from a communication line of video card 230.  
11 When it is determined that a fingerprint image is not normally received, the process returns to step  
12 S525, and the user's fingerprint is again received.

13 The fingerprint data received by communication unit 240 is input to a distinctive feature  
14 detecting unit 221 and its distinctive feature is detected (S540). The quality of the detected  
15 fingerprint data (namely, rate of recognition) is measured (S545). If the quality is so poor that the  
16 detected fingerprint data can not be compared with the registered fingerprint data in the fingerprint  
17 data base 210, an error message is output (S550), the process returns to the step S525, and the user's  
18 fingerprint is again received.

19 If the quality of the detected fingerprint data is good, the detected fingerprint data is  
20 compared with the registered fingerprint data in the fingerprint data base 210, and it is decided  
21 whether there is the identical fingerprint in the data base (S555 and S560).

1 If there is no identical fingerprint data in the registered fingerprint data base, the display  
2 system is recognized as having an impossible to use status and the system cannot be operated (S565).

3 If there is an identical fingerprint data in the registered fingerprint data base, the available value of  
4 the recognized fingerprint is measured (S570).

5 It is then decided whether the measured available value of the fingerprint is included in a  
6 predetermined range (S575). If the measured available value of fingerprint is included in the  
7 predetermined range, the system is recognized as having an enabled for use status (S580) and the  
8 system can be operated by the user. If the measured available value of fingerprint is not included  
9 in the predetermined range, it is decided whether the user has attempted to input a fingerprint a  
10 number of times which exceeds a predetermined number of times (S585). That is, the user can  
11 attempt to input the fingerprint a predetermined number of times, and if the number of times of  
12 inputting a fingerprint exceeds a predetermined number of times, the system is recognized as having  
13 an impossible to use status and the system cannot be operated (S590). If it is determined that the  
14 number of times of inputting a fingerprint is not in excess of a predetermined number of times, a  
15 fingerprint re-input message is output (S595) and the process is returned to the step S515.

16 Fig. 7 is a flowchart illustrating management and registration of fingerprint data applied to  
17 the present invention. As shown in Fig. 7, steps S615 to S655 are the same steps as steps S515 to  
18 S555 shown in Fig. 5, and will not be described in detail.

19 In the step S655, the read fingerprint data of an user is compared with the registered  
20 fingerprint data in the fingerprint data base 210 and it is decided whether the read fingerprint is a  
21 fingerprint of an authorized manager (S660). If it is a fingerprint of an authorized manager, the

1 authorized manager is passed (S670) and the total system is controlled to operate a fingerprint  
2 managing and registering program (S675). If it is not a fingerprint of an authorized manager, the  
3 total system is controlled not to be operated since the system recognizes it as a non-authorized  
4 manager (S665).

5 Fig. 8 is a flowchart illustrating a case applying the present invention to a screen protecting  
6 mode (known in the art) during which a screen is blank or a screen saver program is running. As  
7 shown in Fig. 8, it is decided whether a keyboard or a mouse is moved (S700). If the keyboard or the  
8 mouse is not moved, a screen protecting mode continues to operate (S705). If the keyboard or the  
9 mouse is moved, the routine proceeds with the step S710 to the step S750 which are the same steps  
10 as step S515 to step S555 of Fig. 5 and thus will not be described in detail.

11 Once the user's fingerprint data is read and compared with the registered fingerprint data in  
12 the fingerprint data base 210 in the steps S720-S750, it is decided whether it is a fingerprint of a  
13 registered user (S755). If the read fingerprint is a fingerprint of a registered user, the user is passed  
14 (S765) and the screen protecting mode is dissolved and the total system is controlled to be operated  
15 (S770). If it is not a fingerprint of a registered user, the total system is controlled not to be operated  
16 (S760).

17 Fig. 9 is a flowchart illustrating a routine encoding/decoding a file according to the present  
18 invention. As shown in Fig. 9, it is decided whether a file desired to be executed is a file enabled to be  
19 encoded/decoded (S800). If the file can not be encoded/decoded, an impossible message is output and  
20 a file relevant to a system is executed (S805).

21 If the file can be encoded/decoded, steps S810 to S865 are performed. Steps S810 to S865

1 are the same as steps S710 to S765 shown in Fig. 8 and will not be described in detail.

2 When a user's fingerprint is recognized and passed, an encoding/decoding operation of the  
3 file is performed (S870) and the total system is normally operated.

4 As stated above, the present invention provides an effect of using easily and safely a  
5 fingerprint recognizing function by including a fingerprint recognizing function into a display  
6 apparatus which is the most important interface equipment for an user in a computer environment.

7 In addition, the present invention has an effect resolving a problem caused by a conventional  
8 mouse including a fingerprint recognizing function since a fingerprint recognizing function is  
9 included into a display apparatus.

10 In addition, the present invention allows only an authorized user to enter a computer system  
11 by including a fingerprint recognizing function into a display apparatus so that a terminal securing  
12 function and an encoding/decoding function of important files are provided. Also, a securing  
13 function can be more intensified by providing a function dissolving a screen protection through an  
14 input of fingerprint and a function approving an transaction through a fingerprint in an electronic  
15 commerce system later.

16 Although the preferred embodiment of the present invention has been described, it will be  
17 understood by those skilled in the art that the present invention should not be limited to the described  
18 preferred embodiment, but various changes and modifications can be made within the spirit and  
19 scope of the invention as defined by the appended claims.